Title: Genetic and biochemical mechanisms of superficial scald development in apple and pear fruits

Speaker: Bruce D. Whitaker, Food Quality Laboratory, USDA/ARS/PSI

Abstract:
Superficial scald is a physiological storage disorder of apple and pear fruits. It develops during prolonged cold storage and intensifies after removal to warmer temperatures. Despite many years of investigation, the biochemical mechanism of scald is still unknown. The prevailing hypothesis holds that oxidation products of the sesquiterpene α-farnesene are directly involved via generation of free radicals. A sharp rise in α-farnesene synthesis occurs shortly after scald-susceptible fruit are placed in air storage and oxidation of α-farnesene to conjugated trienols (CTols) proceeds rapidly after about 6–8 weeks. CTol accumulation during storage is usually correlated with the subsequent incidence and severity of scald. Prestorage treatment of scald-susceptible apples or pears with 1-methylcyclopropene (1-MCP), a blocker of ethylene action, drastically reduced both α-farnesene synthesis and scald development. Silencing of genes controlling α-farnesene biosynthesis and/or conversion to CTols should prove or disprove the role of α-farnesene oxidation in the induction of scald. Logical targets for gene knockouts are genes encoding: 1) an isozyme of 3-hydroxy-3-methylglutaryl-CoA reductase (HMGR) committed to sesquiterpene synthesis; 2) α-farnesene synthase (AFS), which catalyzes the final rate-limiting step in α-farnesene biosynthesis; and 3) a currently hypothetical enzyme involved in the production of CTols, possibly a glutathione peroxidase (GPX) or glutathione S-transferase. To date we have cloned genes encoding AFS, three isozymes of HMGR, and a GPX from peel tissue of scald-susceptible apple and/or pear fruit. Expression of these genes in relation to the accumulation of α-farnesene and CTols and the incidence of scald in untreated and 1-MCP-treated apples and pears has been characterized. Results are discussed with respect to the induction of scald by α-farnesene oxidation products, the role of ethylene in scald development, and suppression of α-farnesene synthesis in a scald-susceptible apple or pear cultivar to control the disorder.